[redacted]

BY-61-198 2h

58603

4864

UNIVERSITY OF CALIFORNIA

LAWRENCE RADIATION LABORATORY
BERKELEY 4, CALIFORNIA

December 7, 1961

THIS DOCUMENT CONSISTS OF 10 PAGES
NO 1 OF 2 COPIES, SERIES A

R

SANITIZED COPY

Mr. President:

In accordance with your suggestion I have studied in detail the recommended program of atmospheric tests to be performed in the spring of 1962. In the following I first shall summarize the specific reasons why atmospheric testing has become essential. In the second section I shall give detailed comments on the proposed tests. A last section contains general remarks and recommendations.

SPECIFIC PURPOSES OF THE ATMOSPHERIC TESTING PROGRAM

[redacted]Tell

During the three-year moratorium I had been firmly convinced that the United States must be prepared for the resumption of nuclear testing. I had hoped, however, that atmospheric testing will not become necessary. In this hope I have been wrong. The resumption of atmospheric testing by the Soviet Union has been a surprise to all of us and the scale and success of this test series are impressive. I continue to believe that our national security is not immediately endangered. I do believe, however, that as a consequence of the Soviet program a dangerous situation will arise in the mid-1960's unless we take adequate counter-measures. Among these necessary counter-measures atmospheric testing plays a central role.

The specific danger against which we must guard is the possibility that the Russians can achieve effective defense against a United States retaliatory blow. This can happen because of a combination of two reasons.

The Russians have developed nuclear explosives of impressive power and they have in all probability greatly reduced the weight of their missiles. This will permit them to build a hard-hitting first strike force. Powerful Soviet offensive missiles may destroy almost all of our fixed missile sites. It may also reduce to some extent our mobile forces. Under these conditions our retaliatory blow may be reduced in numbers. At the same time we may be unable to deliver our remaining stockpile in a sufficiently synchronized fashion.

[redacted]

[redacted]

The Russians have claimed progress in the missile defense system. Such progress could indeed have been accomplished by their atmospheric firings. If an offensive blow by the Soviet Union reduces our counterforce, the Soviet missile defenses may be sufficient to stop our retaliatory forces. Such defense might be the more effective if we cannot achieve simultaneity of delivery and if our missiles arrive singly at considerable intervals of time.

An atmospheric testing program of our own will help to counter these dangers for the following specific reasons.

We can achieve smaller weight for a given yield. If the weight is smaller we can afford greater number of rockets, greater number of rocket sites and also somewhat better hardening of our rocket sites. A two-fold reduction in the weight of the warhead may reduce most costs by approximately a factor 2 and may permit the installation of twice as many hardened sites.

In addition, extreme reduction of the weight of some retaliatory warheads to values ..... will make it possible for us to achieve extreme mobility. Mobile dispersal of our missile-carrying rockets on land, sea and air will preserve a much greater proportion of our counterforce from any prospective Russian attack.

Smaller weight nuclear warheads will permit placing several nuclear explosives into the same missile. This may well be a very good method of saturating Russian ICBM defenses.

The most dramatic Russian accomplishment is their 60 MT shot. .....
.....
..... One extremely important consequence of such a high-yield shot is that it can do very extensive damage when detonated at or above 100 KM altitude.

According to present ideas defense against rockets is relatively easy for low-altitude bursts since the atmosphere will slow down the numerous light decoys that can be cheaply delivered together with the nuclear explosive, thus enabling one to recognize the true warhead. The problem of defense above an altitude of 30 or 40 KM becomes progressively more difficult. If we are faced with an effective missile defense on the Russian side we will have to have high-yield weapons of our own

which could do damage from high altitude and not be distinguished from cheaply delivered decoys. While a decision on the yield which we will need may be premature we do have ample reason to emphasize the development of high-yield weapons.

It follows from the preceding discussion that our needs for a retaliatory force makes it necessary for us to develop more numerous and more powerful nuclear explosives. This gives additional incentive for the development of "clean" explosives which produce a minimum fission fallout. While massive production of fission products during an all-out war will not have catastrophic consequences for the human race these fission products will nevertheless cause widespread suffering among noncombatants and possibly among neutrals. .....

.....

.....

.....

.....

.....

.....

The danger to our retaliatory capability makes it particularly important for us to develop our AICBM capability in every reasonable way. It has been correctly stated that a satisfactory AICBM system is exceedingly difficult to perfect, but even limited success might be sufficient to insure our retaliatory capability. Thus we may manage to prevent Russian rockets from detonating on the ground or close to the ground. Our hardened missile sites will survive such air bursts while ground bursts of sufficient accuracy may become dangerous or fatal. Furthermore, prevention of ground bursts will save the United States from intensive fallout. There is therefore a real chance to avoid the widespread danger to human life resulting from such fallout.

The AICBM effort depends on many factors. The vulnerability of nuclear explosives to nuclear detonations is one of the most important components which will determine the feasibility of rocket defense and the penetration of such a defense. We cannot plan our missile defenses in a realistic manner and we cannot insure the success or even the partial success of our counterblow without more knowledge concerning the vulnerability of our rockets and nuclear explosives.

The information and development described above can be obtained in most cases only by atmospheric testing. Underground testing can lead

to important advances. But megaton weapons cannot be tested underground and missile defense experiments must be carried out in the atmosphere. In our present state of preparedness underground experiments will not permit rapid progress. Such progress can be accomplished by atmospheric testing.

Since we have not foreseen the present emergency and since we have not planned for it, the atmospheric testing program of the spring of 1962 will fall short of accomplishing a major portion of the objectives stated above. It is nevertheless essential that we should proceed with an appropriate testing program next spring. The necessarily limited results of such a series will certainly enable us to plan a next series in 1963 in a much more fruitful manner. There is no theoretical way which can replace the hard facts obtained from experience.

DETAILED COMMENTS ON THE PROPOSED ATMOSPHERIC TESTS

The plan which has been worked out by the Laboratory Directors and the Director of Defense Research and Engineering is the result of a careful study with which I agree. According to your request I will attempt nevertheless to make some concrete statements and proposals wherever I can think of a somewhat different point of view or a somewhat different procedure. I shall not mention those items to which I cannot make a relevant contribution.

[redacted]at 3,000 pounds

This development would strengthen our immediate retaliatory capability by making better use of ATLAS and TITAN missiles. I also believe that more powerful weapons in this weight class will be of lasting value. It is possible that sufficient hardening of our ATLAS and TITAN bases will not suffice to protect these missiles from a Soviet strike. However, it is likely that the planned 3,000-pound warhead can be carried in planes which can approach the targets sufficiently so as to deliver their load with the help of light, short-range rockets. These planes could be on almost permanent alert. In addition, other methods of delivery like the light, fast, unmanned nuclear ramjet (PLUTO) should become available. These ramjets are light enough to be dispersed or carried under the ocean and should have a speed at low altitude which will make countermeasures quite difficult.

[redacted]

As stated in the previous section these big yields could be of great importance because weapons of low yields must penetrate more deeply into the atmosphere and can be more easily stopped by the Russian rocket defense. If even bigger yields are required at a future time the experience obtained ..... value in designing such weapons.

The design ..... is not yet frozen. It would be desirable to make an attempt at obtaining .....

A slight modification of the present plan might be considered.

The POLARIS and the MINUTEMAN Warheads

A very considerable portion of our present retaliatory capability rests on the development of bombs in the 600-pound class which are to serve as warheads for POLARIS and MINUTEMAN. During the moratorium a considerable amount of study was devoted to the development of these warheads. Some of these designs are now to be verified and further information is to be obtained by additional experimental shots. The present proposal lists three shots in this weight class.

A greater number of shots have been used by ourselves in the past and apparently also by the Russians when the thorough exploration of a certain weight class became important. The POLARIS and MINUTEMAN warheads may well constitute the backbone of our retaliatory capability during a most critical period. A thorough exploration of this weight class would therefore be indicated. In particular, I am somewhat regretful that the present proposals do not include .....

would also add considerably to the understanding of the way in which these weapons function.

Highly-mobile Retaliatory Missiles

. . . . . .

. . . . . This class appears to me of importance since it will insure an extremely mobile retaliatory force. The mobility and the small weight of the bomb itself give unusually great insurance that these retaliatory missiles will survive an attack. The possibility of clustering these light weapons in one missile may be essential in saturating the Russian missile defense system.

It may not be justified to state that 7 shots in this weight category is the precisely correct number. But the emphasis on this particular development is certainly well placed. Because of the rapidly rising Soviet offensive strength early availability of these warheads is strongly indicated. It is therefore justified that an early effort be made with the help of atmospheric tests and that the slower underground shots should not dictate the pace of this development. The precise sequence of the shots and the optimum number of shots to be fired should depend on agreement between the Laboratories and on the results obtained from the early shots of this type during the test series.

High-altitude Tests

Our information on the effects of high-altitude tests is quite incomplete. We are very strongly interested in this field because of the problem of antimissiles whose functioning depends critically on the blast effects and electromagnetic effects that nuclear explosions can generate in the atmosphere. Our interest is further increased on account of the extremely high yields of Soviet tests. A 100 MT weapon can give rise to exceedingly damaging effects when detonated at high altitudes. Some of these effects are not sufficiently understood. The information which we had obtained in the relevant TEAK, ORANGE and ARGUS shots of 1958 was incomplete and at the same time contained many surprises. These surprises amply demonstrate that effects of this kind are extremely hard to predict. It is in my opinion impossible to make the necessary predictions on the basis of calculations alone with sufficient certainty. Yet such certainty is imperative in designing our passive or active defense which we will have to employ in response to the Russian 60 MT experiment.

Vulnerability Tests

It has been proposed that a test should be carried out to check the vulnerability of hardened missile sites. This test is of the highest importance for the near future since it has direct bearing on the survival of a retaliatory capability. In a second test (SIOUX) the vulnerability of nuclear components is to be tested. It is highly desirable that this test

be carried out in the atmosphere since this will permit more detailed and prolonged observation as well as the study of the shock effects of the components.

The first of these two tests is proposed to be carried out [redacted]

Advanced Concepts

Results from nuclear testing made possible radical improvements in nuclear weapons. In the present test series two designs should be mentioned with particular emphasis.

[redacted] Because of the promise of these experiments early execution is recommended and this may be possible only by performing the experiments in the atmosphere.

Operational AICBM Test

It might be possible to add to the spring test series an attempt to demonstrate the operation of an AICBM carrying a nuclear warhead destroying an incoming missile. For instance, it would be possible to fire a missile from the continental United States to Kwajalein and to destroy this missile with the help of a Nike Zeus missile carrying [redacted] fired from Kwajalein. It is realized that Kwajalein as a trust territory may not be available for political reasons. At the same time the AICBM application should have the strongest support both from technical and political points of view. Kwajalein is probably the only site on which present instrumentation will permit a test of this kind as early as May or June of 1962.

GENERAL REMARKS AND RECOMMENDATIONS

The Need for Flexibility

The proposed tests are most valuable because their outcome cannot be predicted. They should be called experiments rather than tests. The value of the test series will be enhanced if the outcome of the early shots can be used for the purpose of making appropriate changes in the latter part of the series. The relevant judgments have to be carried out by the most experienced people who are actually participating in the series itself. Therefore a high degree of flexibility is most desirable. Such flexibility can easily double the value of the test series.

Limited Instrumentation

According to my present understanding the test series will not be carried out in the Marshall Islands. As a result the instrumentation will not be as complete as it has been in past series and we shall find out fewer details about the functioning of the devices and about the causes of possible failures. It is important to improve the present situation within existing limitations.

The use of Christmas Island would be of particularly great value provided that shots on the ground, on towers or captive balloons will be permitted. This would allow some good instrumentation.

It seems of the utmost importance that adequate instrumentation should be made available for a test series in 1963. In case ground operation on Christmas Island is ruled out a very thorough review of all other alternatives is indicated. Continuing limitation of instrumentation will be a serious handicap in our program.

Underground Explosions

By continued testing underground very important progress can be made, particularly in the field of tactical weapons, primary nuclear explosives to be used in strategic weapons and nuclear explosives which are developed for peaceful applications of nuclear blasts. The limitation of this program is due to available underground tunnels and appropriate vertical holes. If the preparation of these underground sites can be stepped up our whole development will become speedier and the problems connected with a 1963 atmospheric test program will be more

easily solved. We could test more of our nuclear explosives up to 100 KT in these underground sites and we might develop cleaner components which would decrease the fallout which we might have to put into the atmosphere in 1963.

The construction of underground sites could be stepped up if additional money in the amount of at least fifty million dollars per year would be made available. At the same time the present local labor arrangements impose a serious limitation. If an experienced labor force from outside the local area could be brought in the construction of underground sites could proceed with much greater reliability.

Testing in Space

It is probable that some explosives can be tested in deep space more reliably and more completely than anywhere else. Thus it might be found advantageous to test in space nuclear explosives of the highest yield. Space tests will not give rise to fallout and would not have to be inconveniently clustered in a hectic test period. The high altitude tests currently being planned for next spring gives a chance to test some of the diagnostic apparatus which might be used in connection with space testing. A vigorous development of these facilities might mean a further essential reduction of the need for shots in the atmosphere.

It is estimated that the fireing of rockets which could carry an object for space tests will cost from 10 to 15 million dollars a piece. It is furthermore estimated that on the average two such rockets will have to be fired for one successful test. Thus space testing will be fairly expensive. On the other hand, firing of missiles for the purpose of space testing will give valuable experience on the reliability and functioning of rockets. Thus this testing program would produce beneficial results on our development of space technology.

Problems of Personnel

During the extended period of the moratorium the men working on the development of nuclear explosives had been subjected to considerable strain. This was partly due to lack of progress. But in greater part the cause was that public opinion continued to frown upon activities connected with nuclear explosives. Perhaps the most damaging result was the fact that it has become increasingly hard to induce excellent young people to work on nuclear explosives. It is of great importance to do something about improving the present situation.

It would be of the greatest possible value if you, Mr. President, could make a short visit to each of the two weapons laboratories, if you could talk briefly with the senior people, and possibly could address the whole membership of the Laboratory.

It would be of similarly great value if at some appropriate time you could make a public statement directed to the scientists of our Country. In such a statement you might emphasize that the development of nuclear explosives can be used to provide us with the strength that insures peace. You might point out at the same time that the development of nuclear explosives for peaceful purposes is proceeding at an accelerated rate.

It is my firm conviction that the United States does have ample scientific capability to hold its own in the development of nuclear explosives. In the present climate of opinion, however, we are working under great handicaps. Your words and your leadership can have a most profound influence on future developments of nuclear explosives and their effect upon the Nation's welfare and security.

Respectfully yours,

Edward Teller

Edward Teller

The President
The White House
Washington 25, D. C.